

## Compact Optical Carbon Dioxide Monitor for EVA, Phase II

Completed Technology Project (2009 - 2011)



## Project Introduction

Breath respiratory species measurement during extravehicular activity (EVA) or intravehicular activity (IVA) is a demanding application for optical sensing techniques. Yet optical techniques offer many advantages including high-precision, fast response, and strong species selectivity. Accommodation within spacesuits demands that optical sensors meet stringent size, weight and power requirements. The next generation of emerging NASA Constellation spacesuits requires a new generation of CO<sub>2</sub> sensing technology with performance beyond that presently in use on the Shuttle/ISS extravehicular mobility unit (EMU). Vista Photonics proposes to develop rugged, compact, low-power optical sensor prototypes capable of selectively determining carbon dioxide at EVA-relevant concentrations suitable for Constellation Configuration Two Spacesuits. Design variations include dual CO<sub>2</sub> sensors for feeding into astronaut metabolic rate determination and simultaneous humidity measurement for automated suit thermal control. The enabling technology for meeting stringent NASA mission requirements is a new low power infrared optical source that provides the high-sensitivity of established optical absorption detection techniques.

## Anticipated Benefits

Potential NASA Commercial Applications: Phase III commercial applications abound for sensors whose performance and physical characteristics are suitable for spaceflight. Two specifically targeted applications are high-performance medical capnographs for measuring real-time end-tidal breath carbon dioxide in patients and carbon dioxide leak detection at power plant carbon capture & sequestration sites. Other examples include contaminant monitoring in process gas streams in the chemical and microelectronics industries, medical diagnosis through detection of biogenic gases in human breath that correlate to specific pathologies, and environmental monitoring and regulatory compliance in agriculture, power production, and occupational safety. The fully-developed Phase II instruments shall offer a compelling and desirable blend of performance, affordability, compactness, simplicity and ease-of-use relative to present commercial product offerings in these applications.



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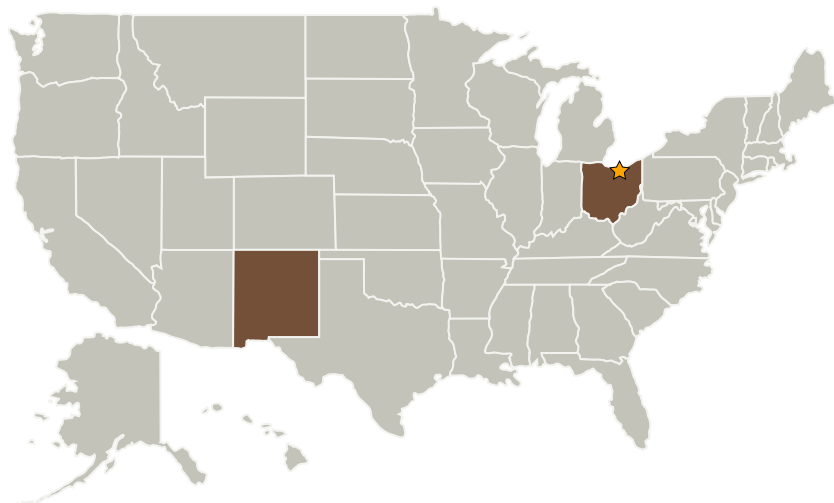
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## Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★ Glenn Research Center (GRC)	Lead Organization	NASA Center	Cleveland, Ohio
Vista Photonics, Inc.	Supporting Organization	Industry	Santa Fe, New Mexico

Primary U.S. Work Locations	
New Mexico	Ohio

## Project Transitions

**January 2009:** Project Start

**January 2011:** Closed out

**Closeout Summary:** Compact Optical Carbon Dioxide Monitor for EVA, Phase II Project Image

## Organizational Responsibility

**Responsible Mission Directorate:**

Space Technology Mission Directorate (STMD)

**Lead Center / Facility:**

Glenn Research Center (GRC)

**Responsible Program:**

Small Business Innovation Research/Small Business Tech Transfer

## Project Management

**Program Director:**

Jason L Kessler

**Program Manager:**

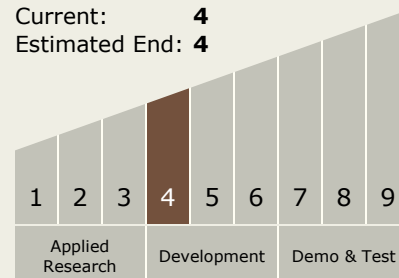
Carlos Torrez

**Principal Investigator:**

Jeffrey S Pilgrim

## Technology Maturity (TRL)

Start: **4**  
Current: **4**  
Estimated End: **4**



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### Technology Areas

**Primary:**

- TX06 Human Health, Life Support, and Habitation Systems
  - └ TX06.2 Extravehicular Activity Systems
    - └ TX06.2.1 Pressure Garment